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*An Extract of the Minutes of the Royal
Society, of February 19, 1746.*

The President in the Chair.

THE President read a Paper, containing an Account of some magnetical Experiments which he, in Company with *William Jones, Esq;* saw on *Wednesday* the 11th of this instant *February*, at the House of *Dr. Gorwin Knight*.

The Doctor, he says, having produced two square Bars of harden'd Steel, of the Length of about 15 Inches, and of the Breadth and Thickness of about half an Inch, and to which he had communicated a strong magnetic Virtue, laid those Bars down upon a Table, so as to be nearly in a strait Line, the North Pole of the one being next to the South Pole of the other, and at the Distance of about half an Inch from it. A small flat Piece of natural Loadstone was then placed between these Bars, so as to be in Contact with the Ends of them both, that were next to each other; where when it had only remained a few Moments, it was found that upon taking it out, the Part of the Stone which had been contiguous to the North Pole of the Bar, attracted the North End of a Compass Needle, and that the Part of the Stone which had been contiguous to the South Pole of the other Bar, attracted in like Manner the South End of the same Compass Needle; and this in whatever Position the natural Loadstone was placed

placed between the Bars : So that, in these Experiments, the Poles of the Stone were first inverted, and then set at Right-angles to the Direction in which they at first lay.

That Dr. *Knight* then gave a strong Touch to two large Sea Compass Needles, the one temper'd, and the other quite hard ; which was done by placing them, successively, one half Part upon one Bar, and the other half Part upon the other ; and then drawing away the Bars, till they were clear of the Needles : By which Operations, both the Needles not only acquired a strong Verticity, but were also enabled to lift with either of their Ends a Weight of better than an Ounce and an half.

NOTE I.

“ The Weight here made use of consisted of
 “ two Pieces of soft Iron joined together with
 “ wax, each Piece weighing about 15 Penny-
 “ weights ; which Weights were sent from
 “ *Deptford*, as a Standard of the Strength of a
 “ Needle touch'd upon their Loadstone, one
 “ of the Weights being the utmost which that
 “ Loadstone could make a Needle lift. Where-
 “ fore this Experiment shews, that these mag-
 “ netic Bars would give a Touch twice as
 “ strong as the *Deptford* Loadstone, for it made
 “ the Needles lift two such Weights ; they also
 “ made the harden'd Steel lift as much as the
 “ temper'd one.”

That these two Needles were then applied to each other ; first, the Northern End of the one, in a contrary Direction to the Northern
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End of the other, and then the Southern End of the first in like Manner to the Southern End of the other; from which Positions, being drawn asunder, it was found, that the temper'd Needle had in a Manner lost all its Virtue, but that the other would still, with either of its Ends, lift better than half of the Weight it lifted before.

N O T E II.

“ The Intention of this Experiment was to
 “ shew how much more durable the Magnetic
 “ Virtue was, when communicated to a Needle
 “ quite hard, than when given to a Needle
 “ temper'd of a Spring Temper (as it must be
 “ when touched upon a natural Loadstone) for
 “ by this rough Treatment the temper'd Needle
 “ was render'd quite useles, whereas the hard-
 “ en'd one was yet a stronger than they could
 “ make at *Deptford*.”

That Dr. *Knight* then touched upon the large Bars one of his small common magnetic Bars, in the same Manner as he had just before touch'd the large Needles; and this Bar, which was applied in a contrary Direction of the Polarity it already had, had its Poles thereby inverted, and lifted after the Touch, with one of its Ends, better than 6 Ounces and 8 Penny-weights.

That Dr. *Knight* lastly produced one of his large artificial armed Magnets, composed of thin Plates of Steel cramp'd together, with which he lifted before them 31 Pounds and 9 Ounces. That with this Magnet, by touching in the common Way the temper'd Needle upon its armed Poles,
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he again restored so much of its former Virtue, as to lift with one of its Ends about three Quarters of an Ounce.

NOTE III.

“ This Experiment shews, that the armed
 “ Magnet gave a Touch nearly of the same
 “ Strength with the Loadstone at *Deptford*, and
 “ that the former Method of touching with
 “ the two Bars was much preferable both to
 “ the Touch of the natural Loadstone, and of
 “ the best artificial Magnets when armed.”

And that by touching in like Manner, but in a contrary Sense, the hard Needle (which yet retained a great Share, as it was observed, of its former Virtue) he not only destroy'd the same, but gave it a new Polarity the contrary Way; but that it would not, after this new Touch, lift more than 9 Penny-weights, that is to say, not half what it lifted when touch'd upon the large Steel Bars.

NOTE IV.

“ Whence it appears that an hard Needle re-
 “ ceives but little Virtue from an armed Magnet,
 “ when touch'd in the common Manner.”

The President had Thanks for this Report; after which, Dr. *Knight* produced before the Society the two large Bars, and all the other Particulars mention'd in the Report, with which he repeated publickly all the several Experiments mention'd above, and which, notwithstanding all the disadvantageous Circumstances of the Place, succeeded perfectly in every Particular, to the Satisfaction of the Company.

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It being then proposed, that the temper'd Needle, having its Virtue again destroy'd, should be touch'd on the fine *Terella* belonging to the Society (which was the noble Present of their very worthy Member, the right honourable the late Earl of *Abercorn*, is esteemed one of the best in *England*, and is said to have lifted in his Lordship's Hands upwards of 40 Pounds) the same was immediately brought up, and the Needle being touch'd therewith, it was found to have acquired a strong Polarity, and to lift about the same Weight, as when touch'd on the Doctor's large armed artificial Magnet, that is to say, about 15 Pennyweights.

NOTE V.

“ This Experiment only serves to shew, that
 “ this celebrated Loadstone gives a Touch nearly
 “ the same with that at *Deptford*, and the
 “ armed Magnet above-mention'd ; so that the
 “ two most esteem'd Loadstones in the King-
 “ dom will not give a Touch, even to a tem-
 “ per'd Needle, of more than half the Strength
 “ of one touch'd by these Bars, and it is well
 “ known that no natural Loadstone will give
 “ a good Touch to an harden'd Needle.”

The Thanks of the Society were given to Dr. *Knight*, for his curious Experiments then shewn before them,

An Account of some new Improvements in Artificial Magnets, communicated to the Royal Society, by Gowin Knight, M.B. F.R.S.

THE *Apparatus* for touching of Needles (which I lately had the Honour to shew to the Society) was as perfect as I could have wish'd, as far as relates to the intended Use of it ; but the Manner, in which the two Bars were disposed in their Cases, render'd the Length of them somewhat incommodious, especially in those of the largest Size. This made me desirous of trying if some Method could not be found out, of placing the Bars parallel to each other, without Danger of weakening their Force ; by which Means the Cases would be reduced to half their Length. I remember'd that some Years ago I had tried some Experiments to this Purpose by placing some Bars parallel, and in Contact, but so that their Poles were turned different Ways ; in which Position I found the Virtue of some of them remain'd pretty entire, but that others were weaken'd thereby. I imagined the Reason of their losing their Force was this ; that the magnetic Virtue was by Degrees habituated to pass out of the Side of one Bar into that of the other in Contact with it, and thereby was hinder'd from arriving at the Ends in it's full Vigour. The Reason why some suffer'd more than others was doubtless to be ascribed to their Difference in Temper. I repeated the Experiment about 2 Months ago with a little Alteration. I placed the Bars parallel, with their Poles in an alternate Position, as before, but not in Contact ; having kept them at the Distance of about a Quarter of an Inch. Then I apply'd to their
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their Ends two Pieces of soft Iron. Each Piece was laid a-crofs, from the North End of one Bar to the South of the other; in the same manner as the Lifter is apply'd to the Feet of an armed Loadstone. The Intention of this was, to draw the magnetic Virtue thereby down to the Ends of the Bars, and to convey it through the Pieces of Iron from one Bar to the other. In this Condition I let them lie for about a Month, and then try'd if they would lift the same Weight as before; which I found they did, and I thought with much more Vigour. After this, I repeated the Experiment with other Bars of various Sizes, and with the same Success. I have therefore now ventured to fit them up in Cases, in the Manner just described.

The Success of this Experiment has led me to another Improvement: I provided a Case of Brass, that wou'd just contain two Bars, such as are sold for half a Guinea. At one End of the Case was fixed two Feet of soft Iron like those of an armed Loadstone, the upper Surfaces of which were, within the Case, in Contact with the Ends of the two Bars; which being parallel to each other, and their Poles in an alternate Position, the North End of one Bar will be in Contact with one of the Feet, and the South End of the other Bar will be in like Manner apply'd to the upper Surface of the other Foot. Upon fitting a Lifter to this new Kind of Armour, I found I was able to support a Weight of about 6 Pounds. The Bars are kept asunder at the Distance of about one Quarter of an Inch, by a Slip of Wood which slides in betwixt them. An

An Instrument thus constructed seems capable of answering all the Purposes for which Loadstones are used: For when the Bars are taken out of the Case, they are fit for touching of Needles, or other magnetical Uses which may require single Bars: When in the Case, the whole together becomes an armed Magnet, able to lift a considerable Weight. And if we want to separate Iron Filings from those of other Metals, the Feet and all the lower Parts of the Case will take them up in great Plenty, and by drawing the Bars a little Way out of the Case, the Filings will fall off.

N. B. The *Apparatus* for touching of Needles is made of four different Sizes. The Price of each Sort is proportionable to the Size of the Bars. Those of the Dimensions described in the Minutes are sold for 10 Guineas, the second sort for 5 Guineas, the third Sort for 2 Guineas and a half, and the smallest Sort for 1l. 5s. The Cautions necessary to be observed, in order to preserve them in their full Vigour, are — First, Never to let the two North or two South Poles approach each other. Secondly, Never to take one Bar singly out of the Case, but let them both slide out together upon a Table, with the Irons at their Ends, and the Partition betwixt them; then taking off one of the Irons, move the two Poles, to which it adhered, asunder, in the Manner you would open a Pair of Compasses, till the Bars are brought to lie in a right Line, the North Pole of one Bar being opposed to the South of the other; then the other Iron and the Partition being removed, they are in a Posture fit for Use: In restoring them again into the Case, observe the same Rule inverted. Thirdly, If you attempt to invert the Poles of too big a Loadstone, or to touch a Piece of Steel of too large Dimensions, the Bars will be weaken'd thereby: The three first Sorts will touch the largest Needles in Use without Danger of impairing their Strength, and invert any Loadstone not exceeding half an Ounce in Weight. Fourthly, Never let them lie long near another Loadstone or Magnet, or any large Piece of Iron or Steel.

These Rules being observed, they will never lose any thing of their Force; and they may lie in any Posture when put up in their Cases.